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Lincoln's brightest policy on solar energy

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The push towards renewable energy is ubiquitous, with reasons varying from greater independence from foreign energy markets to environmental considerations or sustainable futures. Many countries, states, and cities all around the world are pursuing different ways to better their energy generation and Lincoln is no different. The current policy provides some incentive towards residential solar power but can be improved upon. There are typically three mechanisms used for residential photovoltaic (PV) solar generation: Feed-In Tariffs (FITs), Net Metering, and Net Purchase and Sale. This paper will compare the options Lincoln could use and will conclude with what would be the best policy for the city.

One mechanism for residents with photovoltaic systems is Feed-In Tariffs (FITs). With the use of FITs, utilities are obligated to purchase all of the electricity produced by the household's PV system at a set price for a given number of years. This would also require households to purchase all the electricity consumed at standard rates. An equation that can describe whether or not a household will install a PV system is $u_i \geqslant K_i - pz_i$. This states that a household will install a PV system if and only if the Utility from the system is greater than or equal to the total cost of installing the PV system minus the price of PV generated electricity times the amount of electricity the PV system generates.

A different mechanism that may be considered is Net Purchase and Sale. With this option excess generation from a PV system is sold to the utility and is compared in the moment. For example, if the PV system is producing more at 2pm than the household is consuming then that

electricity would be tallied and bought by the utility. Then a minute later the washing machine is in use at the household, this results in the consumption of electricity by the household to be greater than what the PV system is generating resulting in cost to the household for the electricity. The formula for household PV installation is $u_i \geqslant K - p\tilde{x}_i - r\tilde{y}_i$. Similar to the last equation the household will install a PV system under Net Purchase and Sale if and only if the utility from the PV system is greater than or equal to the cost of the PV system minus the price of PV generated electricity times the quantity of PV electricity produced and minus the Standard Rate of Electricity times the amount of PV generation used by the household.

The last option is also the current option used for Nebraska's capital, Net Metering. This is by far the most common practice in the US as more than thirty-five states used it in 2017. Net Metering can be described as a policy that whenever household generation exceeds consumption, the meter runs backwards to the grid. At the end of the billing period the household is paid for the net amount of PV generated electricity if generation was greater than consumption. This equation is $u_i \geqslant K_i \quad -p(z_{g,i} - \tilde{q}_{g,i}) - r(z_{c,i} + \tilde{q}_{g,i})$ and is identical to the Net Purchase and Sale formula but with substituted notation.

It is important to note that Net Purchase and Sale and Net Metering are akin in almost every aspect except how the electricity is accounted for. Net Metering: billing periods. Net purchase and Sale: moment by moment. A characteristic that both Net Metering and Net Purchase and Sale have in common is that if a household with a PV system with either option were to decrease their electricity consumption, the house may be able to increase its sale of PV electricity. This means that both of these options promote households reducing consumption. The magnitude of the reduced consumption would depend on preferences and the price of the PV generated electricity.

A proper comparison should be done between Net Metering and FITs (we exclude Net Purchase and Sale because it is very similar to Net Metering), but do do that we must acknowledge the problems presented by both. If enough residents were to invest in PV systems this would impact utilities as they would supply less electricity to these households. This would cause utilities to lose some revenue and likely hike rates to

combat the loss (cost recovery). The new higher rates would have a harsh influence on non-PV households as they are not able to rely on any other generation except that of the utilities, resulting in greater inequality between PV and non-PV households.

Luckily, most of Lincoln's electricity comes from Lincoln Electric System (LES). LES is a publicly owned municipality, governed by a board of nine administrators appointed by the mayor and provides a primary focus of the organizaiton not on the maximization of profits but promoting safe, reliable, and inexpensive energy to Lincoln. This would mean that policies can be editied and changed in order to best suit the people of Lincoln.

Yoshihiro Yamamoto in 2012 published a study looking at the social welfare outcomes from each policy and from that we can assign what option LES should use. He argued that the highest social welfare comes by Feed-In Tariffs, noting that it is appropriate to set the PV generated electricity price at the sum of the environmental benefit by not using a unit of conventionally produced electricity and the cost to produce a unit of conventional electricity, and to use a subsidy to achieve the targeted amount of households with systems installed. To do this LES could support FITs by either direct subsidies or tax reductions to replace Net Metering.

Sources:

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